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PRODUCTION

JANUARY 1984

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PRODUCTION

January 1984

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NEXT MONTH:
Newly designed hobbing machines advance gear cutting technology. Advantages are increased flexibility, versatility and substantially improved precision.

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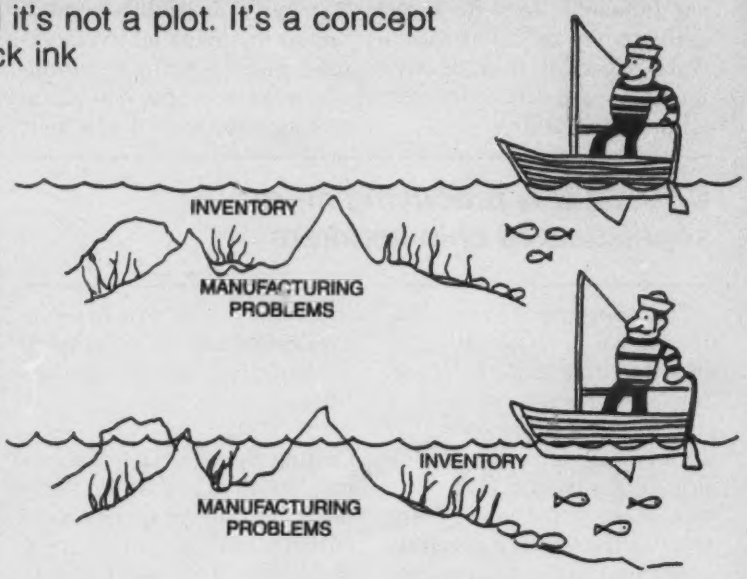
JUST-IN-TIME WORKS!

It's not a panacea and it's not a plot. It's a concept that manufactures black ink

Drew Winter
News Editor



If there is one thing that symbolizes the Just-in-Time (JIT) concept, it is two crude drawings of a man in a boat floating on a river. In the top drawing, the water is high and the boat skims effortlessly over a large pile of submerged rocks. In the second drawing, the water level is far lower and the boat is endangered by the rocks. The rocks are labeled "manufacturing problems" and the water is labeled "inventory."

While many manufacturing people will concede that inventory is used to cover up problems such as unreliable or poorly maintained equipment, poor quality vendor materials, inadequate operator training or poor management, most do not realize just how costly or counterproductive the practice is—at least until they get involved with JIT.

"Just-in-Time is a philosophy," says Edward V. Spurgeon, program manager, Just-in-Time Production Management and Systems Consulting, General Electric Co., Bridgeport, CT. "It isn't the kind of thing that is a program for a year and then it ends. It is a long-term philosophy of deliberately lowering the inventory in your plant, streamlining the way you flow materials through, exposing the problems and permanently resolving them."

Some Benefits. Harley-Davidson Motor Co., Inc., Milwaukee, (which refers to its JIT program as Materials-As-Needed, or M.A.N.) cut its in-process and in-transit inventory by $20 million at just the company's York, PA, assembly plant.

At General Motors' sprawling Buick facilities in Flint, MI, JIT techniques have helped the company cut its inventory on hand and in transit from $48 million to $25 million. Clarence E. Root, Buick Div.'s materials director, is hoping to cut that figure down to $13 million when the $300-million renovation project at Flint called Buick City comes on stream in the summer of 1985. Buick City will produce front-drive Buick LeSabre/Oldsmobile 88 cars, and it will be doing the same job with 1½ million sq ft that the company traditionally would have needed 3½ million sq ft of plant space to do.

JIT programs have been started at approximately 40 different General Electric Co. plants. Inventories have been trimmed in some areas by up to 70 percent and labor productivity gains of up to 35 percent have been made in some pilot applications.

At Hewlett-Packard's Vancouver Div., Vancouver, WA, the company was able to reduce the space necessary to manufacture its line of computer workstation printers from 10,000 sq ft to 2500 sq ft (over a two-year period) while maintaining almost the same production capacity.

According to Bruce Harvey, materials manager, the Vancouver Div. now has ⅕ of the work-in-process (WIP) it orig-

inally had; there is far less scrap and rework; cycle times have been drastically reduced and material leadtimes are now down to two weeks in some cases.

As these figures indicate, inventory reduction is just the tip of the JIT iceberg. For instance, at Harley-Davidson's Milwaukee engine plant, typical setup times on engine manufacturing operations have been cut an average of 75 percent.

"Initial impressions of Just-in-Time tend to focus on inventory reductions," says Lionel (Bud) Chicoine, corporate vice president, Purchasing and Supply, Ford Motor Co., Dearborn, MI. "Most readily pictured is an array of supplier trucks arriving hourly at a plant gate. Let me emphasize that frequent deliveries and attendant inventory reductions are merely the byproduct of a much more elaborate plan. Perhaps the trucks should be even the last step in the implementation process."

Thomas Gelb, vice president-operations, Harley-Davidson Motor Co., Inc. and GE's Spurgeon agree with this assessment.

The following is a breakdown of just what the components of a successful JIT program really are, based on extensive interviews with both OEMs and suppliers who have become involved with JIT:

EMPLOYEE INVOLVEMENT

Attention to detail is the key to

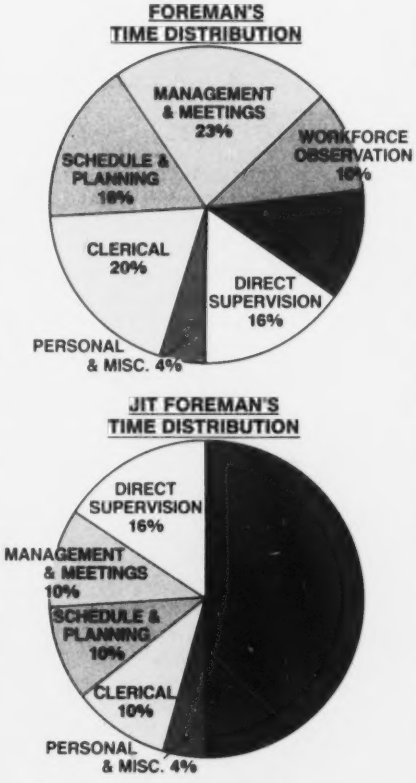
Obstacles to JIT (and how to overcome them)

by Edward V. Spurgeon
Program Manager-JIT
General Electric Co.

Top management is not committed. People do what the boss wants. Therefore, an education process needs to take place at the top of a business. Top executives need to understand what JIT is, what it can do and where it works. Once they have this information, they usually support JIT. Then education, training and implementation proceed with general managers and their plant organizations.

Lack of manpower. JIT is mostly a learning process. You don't need new people to do new things. You need existing people doing old things differently. An example would be if a manufacturing engineer is investigating the purchase of a new high-speed press, he thinks beyond the usual tons of capacity and strokes per minute. He looks into ease of maintenance, reliability, setup time and whether he can locate the press close to the next operation. So what's needed is an education program to instill JIT concepts throughout your organization.

Lowering inventory causes too many problems. One way to solve exposed problems is to get managers and specialists out into the factory solving problems. We typically find that JIT plants have no more staff than non-JIT plants. The difference is that in non-JIT plants salaried workers are spending enormous amounts of time forecasting financial results, reporting on financial results, obtaining approvals and attending meetings instead of solving manufacturing problems.



Traditional performance measurements conflict with JIT. Internal performance measurements were developed years ago when the focus was on specialization of tasks. For example, buyers are measured primarily on material cost with minor emphasis on quality or inventory. Manufacturing engineers are measured largely on labor costs per piece instead of on quality or inventory carrying costs. Quality control is measured on service call rates or complaints, not scrap and rework. It is well within our power to change these narrow measurements and orient new measurements more toward total business objectives.

Suppliers are not located nearby. Getting suppliers to make JIT deliveries has gotten a lot of publicity, but it probably accounts for less than 10 percent of the benefits of JIT programs. The big gains come from improving productivity and quality by flowing parts through your own factory on a daily basis. Until you have reached this point, it is not too important to have your supplier deliver on a daily basis.

No money for new programs. Managers of businesses that are struggling often feel they can't invest a nickel on any new programs. They say "Let's wait until business improves." The sad fact is that if they used JIT to free up dollars locked in excess inventory, they would be able to invest in new programs and equipment.

successful implementation because it requires a great deal of cooperation, acceptance and input from both salaried and hourly personnel.

How organized labor will react to JIT is still a big question mark

Just how organized labor will react to overall JIT techniques is still a big question mark. The strike at Chrysler's Twinsburg, OH, stamping plant dramatically showed this vulnerability.

The whole idea of eliminating large inventories sends shivers down the spine of those in industry accustomed to holding "safety stocks" of raw materials in anticipation of work stoppages. With no material "cushions" to fall back on, it is conceivable that many manufacturers could find themselves in very weak positions when negotiating with organized labor (another large rock surface).

The UAW refused PRODUCTION's requests for interviews to explore this topic further. One thing that is clear, however, is that if JIT is really going to work like it is supposed to, organized labor will have to be solidly behind it.

But unionized employees aren't the only people that have to be convinced of JIT's merits. "Although Harley-Davidson is making progress, it is very slow. Changing the attitudes and past practices of first line and middle management is the real challenge," says Thomas Gelb.

REDUCED SETUP TIMES The ideal situation is zero setups accompanied by lot sizes of one, according to JIT philosophy. Implementers realize this is too idealistic for most current situations, but in order to accommodate the smaller lot sizes the concept dictates, setups have to be improved. Harley-Davidson uses a three-phase approach, which begins with simple, common-sense fixturing improvements and ends with actual product design changes to commonize parts and manufacturing operations.

STATISTICAL QUALITY CONTROL JIT requires a specific quantity of good parts. SQC (performed in-house and by suppliers) is an absolute necessity to provide the quality that JIT demands.

GROUP TECHNOLOGY Approximately 30 percent of floor space can be saved by arranging equipment according to part families rather than equipment families. Very short setup time makes this possible where volume is not high enough for dedicated equipment. Cellular or "focus flow" arrangements mean all departments are self-sufficient

A Supplier Who Signed On

Every day a truck from Harley-Davidson Motor Co., Inc., pulls up to the loading dock of Milsco Manufacturing Co., Milwaukee. It then carries its load of 160 motorcycle seats and assorted accessories on an overnight trip of 800-plus miles to Harley's assembly plant in York, PA. On its way back to Milwaukee, it drops off finished motorcycles at various dealerships on its route.

A diversified manufacturer of custom seating products, Milsco was the first supplier to sign a long-term JIT contract with the motorcycle manufacturer.

"Getting a successful long-term contract relates directly to what kind of relationship you have had with the supplier," says Leroy Zimdars, the Harley-Davidson purchasing agent responsible for negotiating all of the company's long-term contracts.

Milsco has been doing business with Harley-Davidson for 48 years. According to David R. Anderson, president of Milsco, 20 percent of his company's capacity is devoted to Harley (6 percent of that is aftermarket). Though Anderson says his company has a long way to go in the implementation of JIT, he also tells how Harley's M.A.N. system is now an extension of Milsco's MRP system.

"The best thing you can do for a supplier, besides giving him more business, is to give him a steady schedule," says Anderson. "Harley-Davidson is doing that and it's very helpful.

"What Harley-Davidson did, and did very well, is that they just didn't say 'This is what we want to do,' " Anderson continues. "They approached us two years ago and asked our opinion of the concept. We told them that we thought it was a pretty good idea."

David R. Anderson

and include the equipment necessary to produce a finished part from raw materials, such as castings. Each department is put under the control of one supervisor, who is like a mini plant manager, controlling all production, parts, machine utilization and materials flow. There is no paperwork within the department.

CONTAINERIZATION The ideal container should not have more than 10 percent of one day's production. It should be easily transportable within the plant and it should be reusable. Cardboard or dunnage should be eliminated. If parts have to be protected, plastic or other reusable protective materials should be used. When high volumes of parts are used in an operation, it is recommended that smaller bins or tubs be shipped within a larger, reusable overall container.

SCHEDULING (KANBAN) CARDS In various pilot programs at Harley-Davidson the scheduling cards indicate the part machining number, describe the piece, tell what department it is coming from, how many parts go in the container, what kind of container it is, who the supplier is and how many cards/containers are in the whole system.

The cards are put on a rack adjacent to the appropriate cell (there are a limited number of slots) to signal which parts have to run. When parts are in-process, the cards are shifted to the other side of the rack, freeing up the few slots in the incoming rack. When the container is empty, its corresponding card is put into the mail to the appropriate supplier (mail time is built into the system). In its current, imperfect state, the parts shipment trigger is three cards. When a supplier involved with the card system gets his third card in the mail, a truck with three full bins of product (cards attached) is sent to Harley-Davidson.

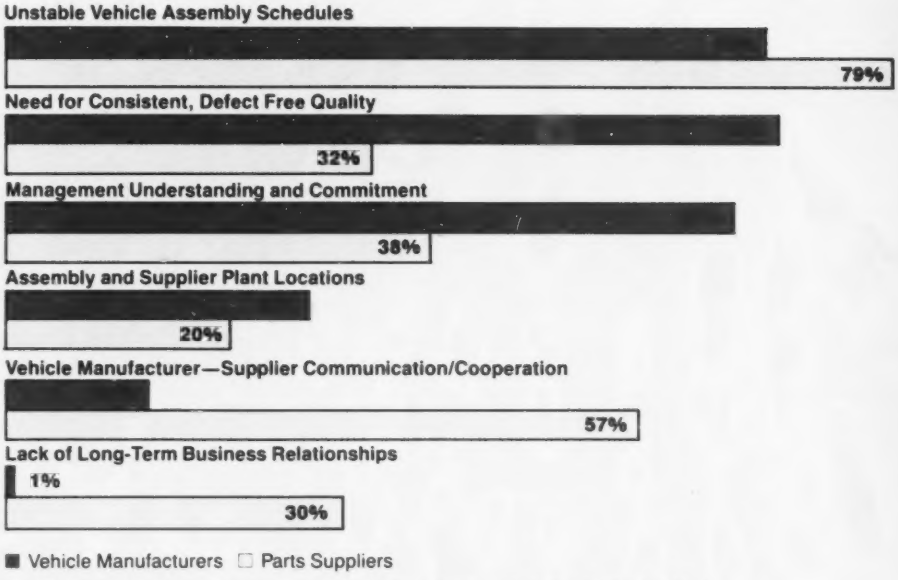
MASTER SCHEDULING A constant flow of parts between suppliers and users is the key to the success of the JIT concept. If the supplier knows on a long-term basis how much product to make and at what intervals it has to be delivered, he can make arrangements with his suppliers and within his plant to work out his own economies of scale.

For example, at Harley-Davidson, two weeks before the start of the month manufacturing, marketing and finance people sit down and determine what the next month's production schedule will be. That number is then frozen, regardless of the demands of the marketplace.

Forecasts are then made for the following month which cannot vary more than ±10 percent from actual production volumes, and for the month after that, they cannot vary more than ±20 percent.

LONG-TERM CONTRACTS Suppliers need strong incentives to make the philosophical and financial commitments that the concept requires. A fair, long-term contract that allows the supplier to lower his costs and stabilize his margins is one of those incentives.

Problems To Be Overcome In Implementing Just-In-Time Approaches



A Delphi study released last summer by Arthur Andersen & Co. indicated that automobile manufacturers and their suppliers have differing views on how to best implement Just-in-Time manufacturing. A number of groups and individuals, most notably the Detroit-based Automotive Industry Action Group (AIAG), are working to surmount this communication problem

TRANSPORTATION CONSOLIDATION Contrary to popular belief, based on Japanese practice, geography is not as important to JIT as most of the other factors mentioned. Suppliers can effectively participate from diverse areas of the country if truck fleets and routes are properly planned, managed and pooled. It is likely that most trucks will make a variety of stops daily at competitors on the way to a user's gates.

COMMUNICATION Poor user/supplier communication is a major reason suppliers complain that JIT manufacturing is a plot to transfer inventory and costs to them. Insufficient communication often leads to misinterpretation of order changes and inappropriate action on the part of the supplier. At least one major manufacturer, in recognition of this problem, is talking about installing computers at its suppliers that link them directly into its MRP system.

"Just-In-Time is the most meaningful thing that has happened since Henry Ford first tied a rope to a car and started the assembly line."

—Thomas Gelb
Vice President - Operations
Harley-Davidson Motor Co., Inc.

SUPPLIER TRAINING AND EDUCATION Suppliers cannot be expected to successfully participate in a JIT program without it. They must learn what the new needs of the user will be and how they can structure their organization and operations to meet those needs. More importantly, the user must educate and assist suppliers in implementing JIT concepts in their own plants. JIT can only truly succeed when it is practiced all the way through the production system, from raw materials to the finished product.

ELIMINATION OF ADVERSARIAL SUPPLIER/USER RELATIONSHIP "A vendor is somebody you go down the street and buy a hot dog from," says Hewlett-Packard's Bruce Harvey. "A supplier is someone who works with you to do a job."

It Can Work. Despite much automotive industry hype, Milwaukee-based Harley-Davidson Motor Co., Inc., is the only implementer of JIT PRODUCTION interviewed that is actively trying to convert its suppliers, potential suppliers as well as those in its own operation to JIT with a religious fervor. Called *Partners-In-Profit*, the presentation it makes to suppliers is structured like a high-powered sales pitch, where the question "What's in it for me?" is answered.

The benefits of the Harley-Davidson M.A.N. (materials as needed) program include:

- A long business relationship with Harley-Davidson
- Reductions in paperwork
- Three and five-year contracts for specific part numbers
- A schedule for each part number sent on a monthly basis, allowing planning for more efficient work schedules and working toward master schedules
- Decreased setup time
- Better process flow
- Less work-in-process
- Shorter leadtimes
- Implementation of statistical process control
- Elimination of final inspection/costs
- Cooperative problem solving
- Standardized packaging and shared expenses

According to LeRoy Zimdars, the purchasing agent who was recently put in charge of establishing long-term M.A.N. contracts, two suppliers have signed on so far and he is at different stages of negotiation with 15 other companies. The presentation has been shown to approximately 60 potential long-term suppliers so far.

Getting suppliers involved in a mutually beneficial arrangement is one of the most difficult parts of the JIT concept, admits GE's Spurgeon. "Our philosophy is not to run out and try to get our suppliers to operate JIT before we get our own house in order," he says. "We are currently concentrating internally on flowing our parts through the various shops on a daily basis. When we do get our parts requirements on a daily basis, then we'll go to our suppliers. But we will be doing it on the basis that there has got to be something in it for them, and that we will be able to show them how to do it without increasing their costs.

"We're going to have to go to longer-term commitments with them, have fewer suppliers, have them located nearby and have specifications and drawings they can meet. That is a major piece of work that has to be done." □

For further information on groups, consultants and books on JIT, circle **500** on PRODUCTION's Reader Service Card.

1984 CAPITAL SPENDING UP 32%

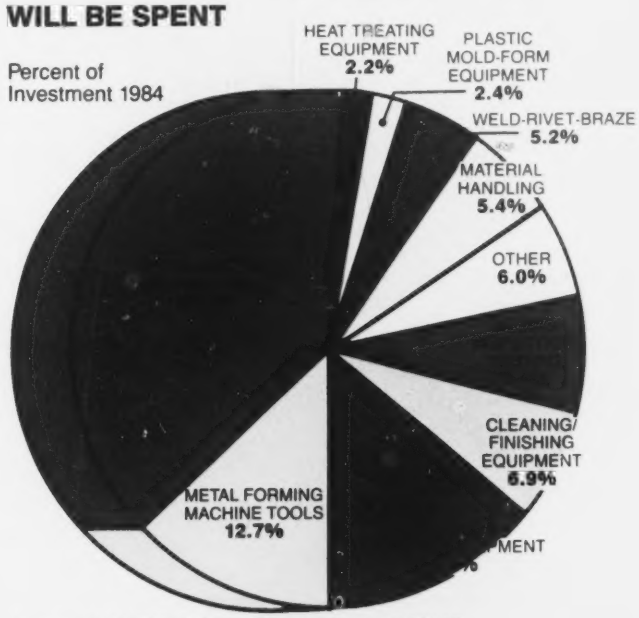
by Edward D. McCallum Jr.
Director-Business Operations

Increased incoming orders are the basis for growth in capital spending by the metalworking industries after two very lean years.*

$9.3 billion for new equipment purchases. That's the figure we're using for our 1984 projections. That's up 32 percent from the $7.0 billion we believe was spent in 1983. It's not a great year compared to spending patterns of the second half of the 1970s, but it's encouraging.

Using projected capital dollar investments of the $9.3 billion pie, we are looking at industry equipment buying along these lines: Metal-cutting machine tools, $3.58 billion, of which approximately $2.36 billion will be sourced domestically; metal forming equipment, $1.18 billion, of which approximately $800 million will be domestic-sourced; assembly machines and equipment, $1.29 billion; cleaning and finishing equipment, $642 million; weld-rivet-braze equipment, $483 million, of which welding equipment makes up 85 percent of the investment; gaging-inspection-testing equipment, $642 million, with inspection equipment accounting for almost 60 percent; material handling, $502 million; heat processing equipment, $205 million; and plastic molding equipment, $233 million.

HOW THE 1984 CAPITAL EQUIPMENT DOLLAR WILL BE SPENT



Source: PRODUCTION's Capital Spending Forecast 1984-85

The Overall Spending Profile

You're typical if your plant is planning its 1984 investment for machinery and equipment as depicted in the chart on this page.

You're also typical if in 1984 . . .

Your plant employs	Your machinery/equipment expenditures are
Less than 50 persons	$ 134,169
50-99 persons	$ 156,138
100-499 persons	$ 551,818
500-999 persons	$1,108,973
1000 or more persons	$2,905,805

Other Highlights

• You were operating at 72 percent of capacity in the late summer of 1983, up from 69.5 percent a year earlier.

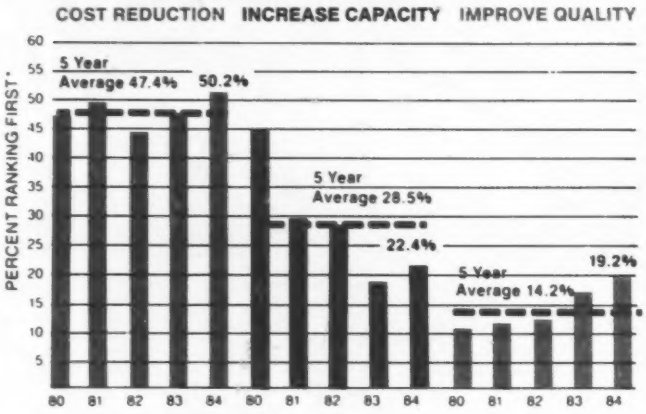
(NOTE: At the time we went to press, you were operating at 78 percent.) 65.4 percent of you planned to operate at a higher level of capacity in 1984, while only 3.8 percent thought they'd be operating at a lower level. And with about half of you reporting increased orders as the reason for higher planned operating rates, we believe the increase is based on economics

**Survey Scope: Plants reached by PRODUCTION in: Fabricated Metal Products (SIC 34); Machinery, except Electrical (SIC 35); Electrical Machinery (SIC 36); Transportation Equipment; and Instruments (SIC 38). 1984 figures are projected from 2525 respondents from 13,500 plants contacted in keeping with past procedures.*

rather than optimism.

- About 34 percent of you reported having approved budgets while another 44 percent expected to have approval by the end of 1983. The remainder wouldn't know their status until after January 1, 1984. Only 8 percent of 1984 budgeted equipment dollars have been placed with suppliers.
- First-year return-on-investment (pre-tax) requirements of 33 percent are unchanged from 1983.
- As in the past, your continuing reliance on and use of numerically controlled equipment is evident. Over the next three years, 46.4 percent of the total respondents plan CNC equipment purchases. Almost six out of ten plants (59.3%) report use of CNC, up from 55.9 percent one year ago. Horizontal and vertical machining centers and horizontal turning machines continue to account for the largest share of CNC purchases over the next few years.
- 10 percent of all responding plants expect to purchase EDM equipment 1984-86. Of these, approximately 60 percent will buy wire EDM.
- 40 percent of the total respondents report they will purchase a portion of their equipment needs from offshore suppliers. The breakdown of these: 52.3 percent plan metalcutting purchases; 11.7 percent plan metal forming purchases; 12.3 percent plan gaging-inspection-testing purchases. Why offshore? 68.7 percent said equipment quality, 62.8 percent said price, 41.1 percent said availability, and 21.3 percent said service.

OVERALL MOTIVES FOR PLANNED MACHINERY/EQUIPMENT INVESTMENTS TOTAL RESPONDENTS 1980-1984*



*Some respondents ranked more than one motive first
Source PRODUCTION's Capital Spending Forecasts 1980-1984

The need to improve quality starting last year is the most dramatic development indicated on this chart. Other motives, not graphed, include: New product/models 16.9 percent ranking first, more make-less buy with 7.5 percent ranking first, followed by energy reduction ranked first by only 3.9 percent of the respondents

Advanced Manufacturing Technologies

Manufacturing Cells. 13.7 percent of the total respondents plan purchase of manufacturing cells over the next three years. A cell is defined as comprising one materials handling device servicing multiple machines, coordinated and paced by a computer or programmable controller.

Flexible Manufacturing Systems (FMS). 11.5 percent of all plants responding plan purchase of FMS over the next three years. An FMS is defined as comprising multiple materials handling devices servicing multiple machines with a computer responsible for coordinating, pacing and scheduling.

Lasers. 14.1 percent of all plants responding plan laser purchases 1984 through 1986. Most lasers will be purchased for gaging/measurement (7.3%). Cutting is the second most popular process with 4.2 percent of total respondents planning purchase, followed by welding (3.3%), drilling (2.5%) and heat treat (1.0%).

Robotics. More than a third of the responding plants (33.9%) will buy robots in the next three years. That reflects a continuing growth rate increase. Two years ago the figure was 21.6 percent; last year, it was 30.5 percent. Robot usage and planned usage breaks down as follows:

Robot Use	Current	Planned
Arc Welding	6.2%	4.6%
Spot Welding	2.5%	2.5%
Assembly	11.7%	7.0%
Load/Unload	15.3%	10.8%
Material Handling	8.7%	6.1%
Spray Paint	6.0%	5.1%

EDITOR'S NOTE: *A complete presentation of the data compiled for the 1984 survey will be presented in PRODUCTION's Manufacturing PLANBOOK to be published in March 1984.*